ME - 11

IMPROVING MATHEMATICAL REPRESENTATION SKILL BY USING PACE MODEL

Andri Suryana
Indraprasta PGRI University
andri_16061983@yahoo.com

Abstract

Many courses in Mathematics Education Program requires a mathematical representation skill. One of them is Mathematical Statistics. Mathematical representation is way that used someone to express mathematical ideas visually, mathematical expressions, or written text. However, most of the students have difficulty in representing mathematical problems. One of models to improve mathematical representation skill is PACE model. PACE model is a model based on constructivist learning that has phase: Project, Activity, Cooperative Learning, and Exercise. This model is important to apply in mathematics teaching, because it can improve mathematical representation skill.

Keywords: Mathematical Representation Skill, PACE Model

INTRODUCTION

To learn mathematics, students need mathematical skills. One of them is Mathematical Representation Skill. Representation Skill can help students in understanding, communicating, and connecting mathematical concepts (Hudiono, 2005). However, mathematical representation skill of students is very limited (NCTM, 2000), because they always use symbolic representations. Representation can be seen as a bridge that connects part of "concrete" and "abstract" in mathematics (Gravemeijer, 1994). One of courses in Mathematics Education Program that requires Mathematical Representation Skill is Mathematical Statistics. Based on observations at one of university in South Jakarta, the students had difficulty in changing abstract ideas presented in problem of Mathematical Statistics to a real concept in finding solutions.

To improve mathematical representation skill in Mathematical Statistics Course, we need a model of learning that provides opportunities for students to be active in the classroom and can construct the concepts to their own abilities. One model that is according to constructivist learning theory that emphasizes on actively students is PACE model. The PACE model was developed by Lee (1999) which is an abbreviation of Project, Activity, Cooperative Learning and exercise. Students are taught by the PACE model is more active in the classroom by class discussion (Lee, 1999).

Formulation of the problem in this study is how application of the model PACE in improving Mathematical Representation Skill?. The goal of this study is to know the application of the model PACE in improving Mathematical Representation Skill.

Because the model is very important to be applied in teaching, it will be studied in depth in theory about the application of the PACE model in improving mathematical representation skill. The benefit of this study, the model can be a reference in improving the quality of learning to be more effective and efficient.

EXPLANATION

Mathematical Representation Skill

According Cai, Lane and Jakabcsin (in Suparlan, 2005), the representation is a way to express mathematical ideas. Variety representation is often used in communicating mathematics are tables, drawings, graphs, mathematical expressions, and written text.

Representation relating to the interpretation. They gave different meanings according to context in the learning process. Lesh (in Suparlan, 2005) confirms that all mathematical models are useful, but depending on the learning objectives. Moreover, Mudzakir (2006) in his research, classifying mathematical representation into three forms of representation, that are: 1) a visual representation; 2) a mathematical equation or expression; and 3) The words or written text.

Based on description above, the mathematical representation skill in this study is skill in expression or modeling of ideas, ideas or mathematical concepts in a visual form; equations or mathematical expressions; and words or written text.

PACE Model

The PACE model was developed by Lee (1999) for statistical learning, which stands for Project (Project), Activity (Activity), Cooperative Learning (Cooperative Learning) and exercise (Exercise). Students are taught by the PACE model is more active in the classroom by class discussion (Lee, 1999). PACE model is based on the principles: (1) construct their own knowledge by guidance, (2) practice and feedback is important, and (3) active learning priority in solving a problem. PACE model require computer technology (Lee, 1999).

In this study, the PACE model will be adapted to the characteristics of Mathematical Statistics Course. Because the courses are rarely used computer technology, it requires more analytic theory and more emphasis on deductive reasoning. In other words, learning PACE use Worksheet.

The project is an important component of the PACE model. Laviatan (2008) says that the project is an innovative form of learning that emphasizes the complex activities to solve problems based on inquiry activities. Project activities in the form of groups. They can choose their own topics. They were asked to find solutions to the problems of his choice. They should make a report of the project. In this project, students are required to be active, critical and creative. Through the project, students better understand the concepts and can improve retention and can explore mathematical abilities, both cognitive and affective abilities.

The aim of Activity in PACE model is to introduce students to information or new concepts by giving a task in the form of Activity Worksheet. Activity Worksheet is one form of the Student Worksheet to learn the material. Through Activity Worksheet, students are given the opportunity to find their own concepts that will be learned.

Cooperative learning in the PACE model is implemented in the classroom. In the study, students work in groups and discussions to find solutions of the problem in the Discussion Worksheet. Discussion Worksheet is a form of the Student Worksheet too to learn the material. Through Worksheet discussion, students had the opportunity to present the findings obtained during the discussion. During the discussion, students exchange ideas in order to get a correct understanding of the concept.

The purpose of exercise in the PACE model is to reinforce the concepts that have been constructed on activities and cooperative learning. This exercise is given to students in the form of additional duties in Exercise Worksheet. Through Exercise Worksheet, students can understand the material better. Phase exercises related to reflection, that is to re-examine the results and the process (Polya, 1981).

Based on description above, the PACE model in this study is a model of learning based on constructivism which has a phase: Projects, Activities, and cooperative learning exercises using Worksheet Students in the learning process.

Application of the PACE Model in Improving Mathematical Representation Skill

Application of the PACE model in improving mathematical representation skill seen from the learning phase, that is:

1) In the activity phase, the lecturer gave Activity Worksheet for students to do at home. At the time of the lecture, the lecturer with students discussing the Activity Worksheet. Examples of problems in Activity Worksheet is:

> To understand the function of the joint probability of two random variables, consider the following illustration.
>
> Two balls are drawn from a bag containing 3 black balls, 2 yellow balls and 3 red balls. Let X and Y is the number of black balls and yellow balls are drawn.
>
> a) Determine the possible values of the random variables X and Y.
> b) Determine the joint probability function, $p(x,y)$.
> c) Make a chart of the joint probability distribution, $p(x,y)$.
> d) Compute $\sum_x \sum_y p(x,y)$.

2) In cooperative learning phase, the lecturer gave Discussion Worksheet to each group. This is a continuation of Activity Worksheet that has a higher level of difficulty. Examples of problems in Discussion Worksheet is:

> Suppose the function $h(x,y)$ has the form:
>
> $$h(x,y)=\begin{cases}\frac{1}{x};\ 0<y<x<1\\ 0;\ x,y \text{ other}\end{cases}$$
>
> Describe the domain of the function, then if X and Y are stochastically independent random variables? Describe your answer.

3) In the exercise phase, the lecturer gives an additional task in Exercise Worksheet to reinforce the concepts that have been constructed in activity and cooperative learning. Through this phase, students are asked to try various types of questions that reinforce the concepts. Examples of problems in Exercise Worksheet is:

Suppose joint probability distribution $s(x, y)$ given in the following table.

		Y		
		0	1	2
X	0	0,05	0,05	0,10
	1	0,10	0,25	0,05
	2	0,10	0,15	0,05
	3	0,05	0,05	0

Determine the value of $\sum_{y=0}^{2} s(x, y)$ and $\sum_{x=0}^{3} s(x, y)$.

4) In the project phase, the lecturer gives Project Worksheet. Project activities in the form of groups. They can choose their own topics. They were asked to find solutions to the problems of his choice. They should make a report of the project. Examples of problems in Project Worksheet is:

PROJECT TASK

Topic Problem: Markov Chain

Instructions:

1. Each group should choose one Markov Chain applications, for example the Markov chain in displacement brands, shopping, a game of snakes and ladders, weather forecasts, stock price fluctuations, and others.
2. Each group conducted an investigation directly into the field by Markov Chain applications selected.
3. Understand the questions in this project assignment. If you experience difficulty, please consult with the lecturer.
4. Make a report on a group project assignments and collected in the last lecture.
5. Each group should present the results of the project tasks.

The questions:

1. Describe the Background of Markov Chain Application.
2. Describe the Markov Chain.
3. Describe the Probability Matrix Transition. Give an examples.
4. Describe the n-step transition probability.
5. Describe the Chapman Kolmogorov equation along with its proof. Give an example.
6. Describe the state vector and steady state conditions. Give an examples.
7. Describe the Markov Chain Applications which your group choose.
8. Describe the research methods used in this project.
9. Construct a table of raw data directly from the results of the investigation.
10. Construct a table of transition probability.
11. Develop a query based on the tables that were made previously regarding

the conditional probability, conditional expectation, and conditional variance.

12. Describe the discussion based on the results of the investigation directly from the field and the tables were made previously.
13. Provide conclusions and suggestions based on the discussion above.

Write the libraries that you use in the task group 's project.

Based on the above steps, shown theoretically that the PACE model can be applied to improve the mathematical representation skill in Mathematical Statistics Course.

CONCLUSION AND SUGGESTION

Students are required to explore the potential of mathematical representations in learning Mathematics Statistics Courses. One of the models in order to improve the ability of the PACE model is a mathematical representation. PACE model is one based on constructivist learning model that has phase: Project, Activity, Cooperative Learning), and exercise. Through this study, expected to be developed in the direction of further research.

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